Pipe2.0 User Manual

A、Symbols：

- C：roughness factor of pipe
- D_n：nominal pipe diameter (mm, in)
- D_i：internal diameter based on D_n (mm, in)
- D_c：D_i calculated by formula (mm, in)
- D_{nd}：D_n for D_i lower than D_c (mm, in)
- D_{nu}：D_n for D_i higher than D_c (mm, in)
- D_{id}：internal diameter based on D_{nd} (mm, in)
- D_{iu}：internal diameter based on D_{nu} (mm, in)

- $\mathbb{EL}$：equivalent straight length (m, ft)
- F_d：design head loss (mAq/m, ftAq/100ft)
- F_n：nominal head loss (mAq/m, ftAq/100ft)
- F_s：pipe section head loss (mAq/m, ftAq/100ft)
- F_1：total head loss (mAq/m, ftAq/100ft)
- $\mathbb{H}$：specified pump head (mAq, ftAq)
- H_c：calculated pump head (mAq, ftAq)
- HP_c：calculated pump motor power (HP&kw)

- pcs：pieces (quantities)
- Q：specified flow rate (Lps, gpm)
- Q_d：design flow rate (Lps, gpm)
- Sg：specific gravity
- V_d：design flow velocity (m/s, fps)
- V_n：nominal flow velocity (m/s, fps)
- θ_m：motor & mechanical efficiency
- θ_p：pump efficiency

B、Qperating Steps：

1. The first screen is fig.1.　Click「Download English User Manual」if necessary.
2. Click SI Edition or IP Edition (fig.2).　Then, click New Piping Sizing or Latest Records (fig.3～6).
3. Select Water System：　(★If "other" is selected, input C value) (fig.7)

Water System	Cooling Water open, steel	45%wt Ethy. Glycol (−22℃),closed, steel	30%wt Ethy. Glycol (−10℃), closed, steel	Open pipe PVC、ABS…	Chilled Water closed, steel	70℃(160℉)Water closed, steel	Closed pipe PVC、ABS…	other
C value	① 100	⑥ 105	⑤ 120	④ 130	② 140	⑦ 145	③ 150	⑧ input

　※This software adopts Hazen-Williams Equation, the reasonable C Value is between 80 and 160.

4. Select Pipe Diameter(D_n)：Select □1.Q_d＋F_d, □2.Q_d＋V_d or □3.Q_d＋D_n and input.　One Pipe No. at a time (Max. 21).　Basically, for Q_d≦50Lps (or 800gpm), take F_d＝0.05mAq/m(5ftAq/100ft); otherwise, take V_d＝3m/s(10fps).　Click Calculate and check the recommended values below for selecting D_{nu} or D_{nd}(fig.8)；　the default selection depends on which D_i is closer to D_c.　The recommended V_n and F_n are：

D_n , mm (in)	≦ 25 (1")	≦ 65 (2.5")	≦ 125 (5")	≦ 250 (10")	≧ 300 (12")
V_n , m/s(fps)	0.8～1.2 (2.5～4)	1.2～2.1 (4～7)	1.5～3 (5～10)	1.8～3.6 (6～12)	2.4～4 (8～13)
F_n , mAq/m(ftAq/100ft)	(5～10)x10^{-2} (5～10)		(3～8)x10^{-2} (3～8)	(3～6)x10^{-2} (3～6)	(0.5～5)x10^{-2} (0.5～5)

　※This software is suitable for 0.5"～40" D_n pipes.　For D_n≦20", D_i bases on steel pipe SCH40; for D_n≧22", D_i bases on steel pipe SCH20.

5. Calculate Piping Total Head Loss (F_1, Aq)：(fig.9～10)

　　The Q_d, D_n, V_n and F_n in item Ⅱ will be transferred to item Ⅲ automatically.　Input straight pipe length and the quantities of valves and fittings.　Then, click Calculate, and the Equivalent Length (EL), Section Head Loss (F_s) and Total Head Loss (F_1) shall be shown in Item Ⅲ.

6. Calculate Pump Head (H_c, Aq)：(fig.11)

　　Input the suitable values for F_1～F_7, and H_c shall be shown in item Ⅳ.　Although there are recommended values for F_2～F_6 as bellow, the maker's data are preferred.

　　　　F_1：Piping Total Head Loss, mAq (ftAq)
　　　　F_2：Condenser or Evaporator Head Loss, 6～9mAq (20～30ftAq)
　　　　F_3：Fan Coil or Air Handing Unit Head Loss, 3～6mAq (10～20ftAq)
　　　　F_4：Heat Exchanger Head Loss, 4.6～7.6mAq (15～25ftAq)
　　　　F_5：Adjusting or Balancing Valve Head Loss@1/4 closed, 1.5～4.0mAq (5～13ftAq)
　　　　F_6：Cooling Tower Head Loss, mAq (ftAq)

circle：3～7m(10～23)	counter flow：6～9.1m(20～30)	cross flow：3.6～6m (12～20)	fan-free：15～20m (50～65)

　　　　F_7：Others：suction head, other valve,etc. ,m (ft)

7. Calculate Pump Motor Power Required (HP_c)：(fig.12)

　　Input suitable Q, H, Sg, θ_p and θ_m and click Calculate to obtain HP_c.

　　★1：Recommended θ_p & θ_m：(maker's data are preferred.)

D_n, mm	≦50(2")	65(2.5")	80(3")	100(4")	125(5")	150(6")	≧200(8")
θ_p	0.4～0.5	0.45～0.55	0.5～0.65	0.6～0.7	0.65～0.75	0.7～0.8	0.75～0.88
θ_m	0.6～0.7			0.7～0.85			0.8～0.9

　　★2：Sg：specific gravity ※1.00 for 4.4～37.8℃ (40～100℉) water (maker's data are preferred.)

30%wt Ethy. Glycol：1.05	45%wt Ethy. Glycol：1.08	70℃ (160℉) water：0.978

8. Specify pump specifications：Input suitable data in item Ⅵ. (fig.13)
9. Save before Print, End, or Restart (fig.13). (fig.14～15 are printouts)

C、Disclaimer：

　　We (Tempace, Inc., developer and the distributors of this software) have done our best to avoid any errors.　However, we do not warrant that the information in this software is error-free.　The entire risk as to the quality and performance of this software is with you.　In no event shall we be liable to you for any damages and losses, arising out of using this software.

Tempace, Inc.：http://www.hvacnr.com.tw　　Fax：886-7-5572055　　Email：tempace@yahoo.com.tw

fig.1

fig.2

fig.3

Fig.5 will be shown if click here.
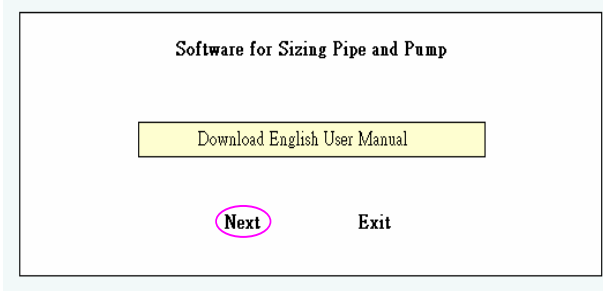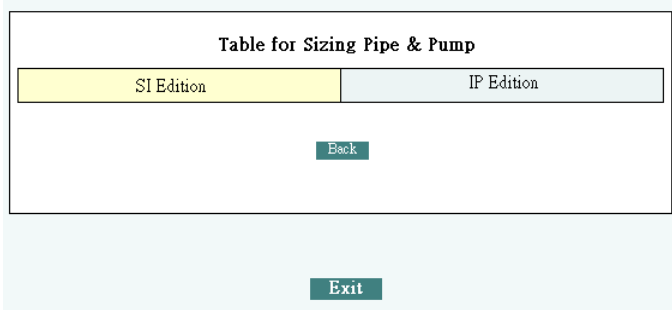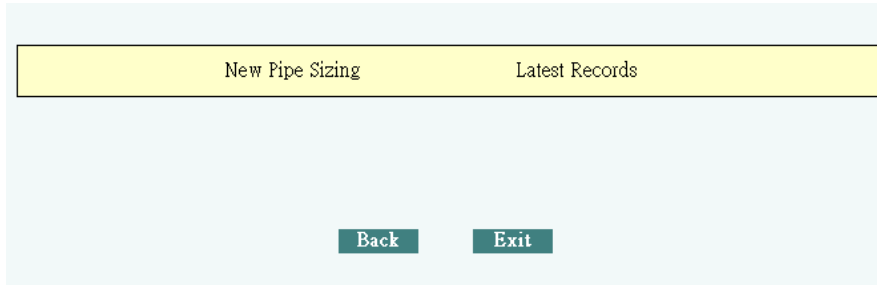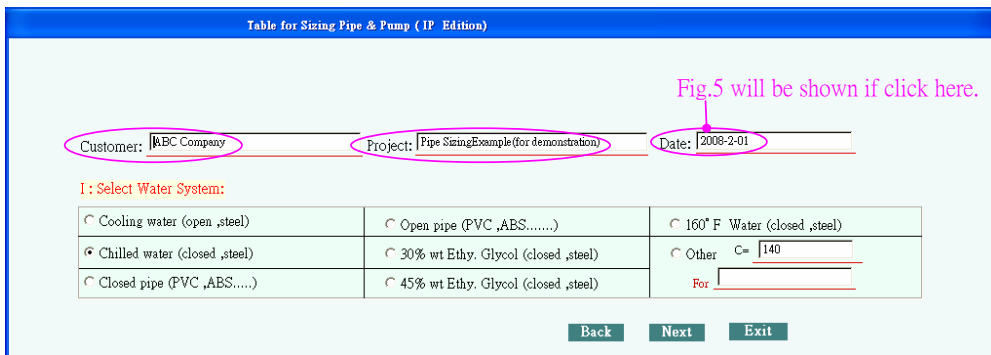
fig.4 (Input customer、Project and Date if new Pipe Sizing is selected)

fig.5

※The Customer name must be changed if you want to keep it as a new file

SN	Customer	Project	Date and Time	File	Edit	
1	ABC Company	Pipe SizingExample(for demonstration)	2008-2-01 and 15:53:31	List	Modify	Delete

Back   Exit

fig.6 (Click Modify for the required file.)

Table for Sizing Pipe & Pump (IP Edition)

Customer: ABC Company   Project: Pipe SizingExample(for demonstration)   Date: 2008-2-01

I : Select Water System:

○ Cooling water (open ,steel)	○ Open pipe (PVC ,ABS.......)	○ 160° F Water (closed ,steel)
⊙ Chilled water (closed ,steel)	○ 30% wt Ethy. Glycol (closed ,steel)	○ Other C= 140
○ Closed pipe (PVC ,ABS.....)	○ 45% wt Ethy. Glycol (closed ,steel)	For ___

Back   Next   Exit

fig.7(ABC company is a DEMO；refer to fig.16)

Software for Sizing Pipe and Pump

Table for Sizing Pipe & Pump (IP Edition)

※Each screen has 6 Pipe sections；select 2 for the 7th pipe section.

II: Determine Pipe Nominal Diameter(Dn,in)   Total: 4 pages   1   Back   Next   Exit

First pipe section (※1Lps=60Lpm=3.6cmh=15.852gpm ; 1mAq/m = 10 kpa/m=0.1 bar/m ; 1m=3.28 ft)

select
1、2or3
input
click

Pipe No: 01	Dc(in):	3.67	Pipe No: 02	Dc(in):	4.78	Pipe No: 03	Dc(in):	5.57
⊙ 1:Q_d 240	gpm,F_d 5	ft/100ft	⊙ 1:Q_d 480	gpm,F_d 5	ft/100ft	⊙ 1:Q_d 720	gpm,F_d 5	ft/100ft
○ 2:Q_d	gpm,V_d	fps	○ 2:Q_d	gpm,V_d	fps	○ 2:Q_d	gpm,V_d	fps
○ 3:Q_d	gpm,D_n	in	○ 3:Q_d	gpm,D_n	in	○ 3:Q_d	gpm,D_n	in
Calculate			Calculate			Calculate		
⊙ D_{nu} = 4.00 in D_{lu} = 4.026 in	○ D_{nd} = 3.00 in D_{ld} = 3.068 in		⊙ D_{nu} = 5.00 in D_{lu} = 5.047 in	○ D_{nd} = 4.00 in D_{ld} = 4.026 in		⊙ D_{nu} = 6.00 in D_{lu} = 6.065 in	○ D_{nd} = 5.00 in D_{ld} = 5.047 in	
V_n (fps)	F_n (ft/100)	V_n (fps) F_n (ft/100)	V_n (fps)	F_n (ft/100)	V_n (fps) F_n (ft/100)	V_n (fps)	F_n (ft/100)	V_n (fps) F_n (ft/100)
6.05	3.212	10.42 12.068	7.70	3.856	12.10 11.595	8.00	3.339	11.55 8.171
Pipe No: 04	Dc(in):	7.04	Pipe No: 05	Dc(in):	8.28	Pipe No: 06	Dc(in):	9.39
○ 1:Q_d	gpm,F_d	ft/100ft	○ 1:Q_d	gpm,F_d	ft/100ft	○ 1:Q_d	gpm,F_d	ft/100ft
⊙ 2:Q_d 1200	gpm,V_d 9.9	fps	⊙ 2:Q_d 1680	gpm,V_d 10	fps	⊙ 2:Q_d 2160	gpm,V_d 10	fps
○ 3:Q_d	gpm,D_n	in	○ 3:Q_d	gpm,D_n	in	○ 3:Q_d	gpm,D_n	in
Calculate			Calculate			Calculate		
⊙ D_{nu} = 8.00 in D_{lu} = 7.981 in	○ D_{nd} = 6.00 in D_{ld} = 6.065 in		○ D_{nu} = 10.00 in D_{lu} = 10.020 in	⊙ D_{nd} = 8.00 in D_{ld} = 7.981 in		⊙ D_{nu} = 10.00 in D_{lu} = 10.020 in	○ D_{nd} = 8.00 in D_{ld} = 7.981 in	
V_n (fps)	F_n (ft/100)	V_n (fps) F_n (ft/100)	V_n (fps)	F_n (ft/100)	V_n (fps) F_n (ft/100)	V_n (fps)	F_n (ft/100)	V_n (fps) F_n (ft/100)
7.70	2.258	13.33 8.598	6.83	1.390	10.77 4.210	8.79	2.214	13.85 6.706

fig.8

Software for Sizing Pipe and Pump

Table for Sizing Pipe & Pump (IP Edition)

III: Calculate Piping Total Head Loss(F1 ,ftAq) (※1Lps=60Lpm=3.6cmh=15.852gpm ; 1mAq/m == 10 kpa/m=0.1 bar/m ; 1m=3.28 ft)   Back   Calculate   Exit

Head loss in valves & fittings in terms of equivalent length-EL (ft)

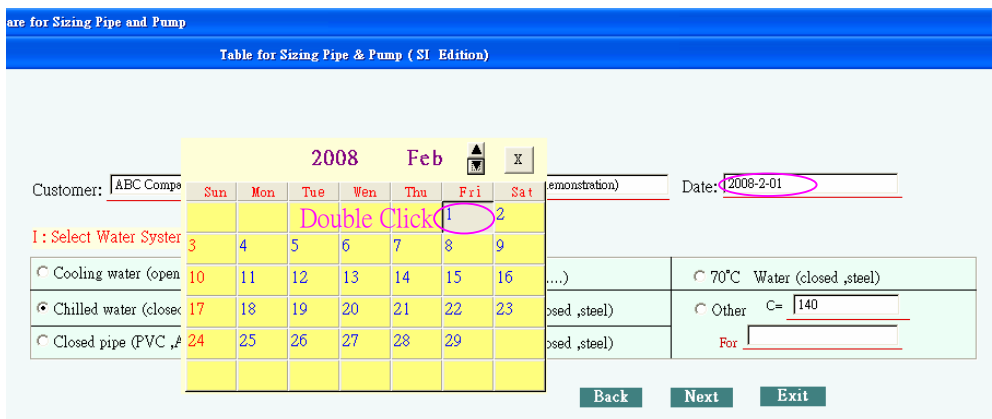| Pipe No	Q_d gpm	D_n in	V_n fps	F_n ft/100'	straight pipe length ft	gate valve	butterfly valve	globe valve	angle valve	lift check valve	swing check valve	y type strainer	90° std elbow	90° long elbow	tee straight	tee branch	contract D/d=4/3	enlarge d/D=3/4	EL (ft)	section head loss Fs, ftAq
1	240	4.000	6.050	3.212	130	4 pcs	pcs	pcs	pcs	pcs	pcs	1 pcs	pcs	7 pcs	pcs	pcs	pcs	pcs		
2	480	5.000	7.700	3.856	120	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	1 pcs	1 pcs		
3	720	6.000	8.00	3.339	90	pcs	2 pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	2 pcs	pcs	1 pcs	1 pcs		
4	1200	8.000	7.700	2.258	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	1 pcs	1 pcs		
5	1680	8.000	10.770	4.210	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	pcs	pcs		
6	2160	10.000	8.79	2.214	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	1 pcs	1 pcs		
7	2640	10.000	10.740	3.210	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	pcs	pcs		
8	3120	12.000	8.940	1.864	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	1 pcs	1 pcs		
9	3600	12.000	10.32	2.429	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	pcs	pcs		
10	4080	14.000	9.680	1.981	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	1 pcs	1 pcs		
11	4560	14.000	10.810	2.373	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	pcs	pcs		
12	5280	16.000	9.59	1.624	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	0 pcs	1 pcs	1 pcs		
13	5760	16.000	10.460	1.908	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	pcs	1 pcs	pcs	1 pcs		
14	5760	24.000	4.350	0.226	10	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs	pcs	1 pcs	pcs		
15	1920	10.000	7.81	1.780	180	pcs	3 pcs	pcs	pcs	pcs	1 pcs	1 pcs	9 pcs	pcs	1 pcs	pcs	pcs	pcs		
16	3840	12.000	11.010	2.738	16	pcs	0 pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	1 pcs	pcs	pcs	pcs		
17	5760	16.000	10.460	1.908	150	pcs	pcs	pcs	pcs	pcs	pcs	1 pcs	pcs	pcs	1 pcs	pcs	1 pcs	pcs		
18						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs		
19						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs		
20						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs		
21						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs		

Total Head Loss(F1,ftAq):

fig.9(Input straight pipe length and the quantities of valves and fittings)

Software for Sizing Pipe and Pump

Table for Sizing Pipe & Pump (IP Edition)

III: Calculate Piping Total Head Loss(F1 ,ftAq) (※1Lps=60Lpm=3.6cmh=15.852gpm ; 1mAq/m == 10 kpa/m=0.1 bar/m ; 1m=3.28 ft)   Back   Next   Exit

Head loss in valves & fittings in terms of equivalent length-EL (ft)

Pipe No	Q_d gpm	D_n in	V_n fps	F_n ft/100'	straight pipe length ft	gate valve	butterfly valve	globe valve	angle valve	lift check valve	swing check valve	y type strainer	90° std elbow	90° long elbow	tee straight	tee branch	contract D/d=4/3	enlarge d/D=3/4	EL (ft)	section head loss Fs, ftAq	Edit
1	240	4.000	6.050	3.212	130	4 pcs 10.560	pcs	pcs	pcs	pcs	pcs	1 pcs 70.520	7 pcs 70.490	pcs	pcs	pcs	pcs	pcs	151.6	9.0	Delete
2	480	5.000	7.700	3.856	120	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 16.820	pcs	1 pcs 3.750	1 pcs 5.360	25.9	5.6	Delete
3	720	6.000	8.00	3.339	90	pcs	2 pcs 45.480	pcs	pcs	pcs	pcs	pcs	2 pcs 30.320	pcs	2 pcs 20.220	pcs	1 pcs 4.810	1 pcs 6.870	107.7	6.6	Delete
4	1200	8.000	7.700	2.258	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 26.600	pcs	1 pcs 6.780	1 pcs 9.690	43.1	1.6	Delete
5	1680	8.000	10.770	4.210	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 26.600	pcs	pcs	pcs	26.6	2.4	Delete
6	2160	10.000	8.79	2.214	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 33.400	pcs	1 pcs 8.520	1 pcs 12.170	54.1	1.9	Delete
7	2640	10.000	10.740	3.210	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 33.400	pcs	pcs	pcs	33.4	2.0	Delete
8	3120	12.000	8.940	1.864	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 39.800	pcs	1 pcs 10.930	1 pcs 15.610	66.3	1.8	Delete
9	3600	12.000	10.32	2.429	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 39.800	pcs	pcs	pcs	39.8	1.7	Delete
10	4080	14.000	9.680	1.981	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 43.760	pcs	1 pcs 12.010	1 pcs 17.160	72.9	2.0	Delete
11	4560	14.000	10.810	2.373	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 43.760	pcs	pcs	pcs	43.8	1.8	Delete
12	5280	16.000	9.59	1.624	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 50.020	0 pcs	1 pcs 13.730	1 pcs 19.610	83.4	1.8	Delete
13	5760	16.000	10.460	1.908	30	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 75.000	pcs	pcs	1 pcs 75.000	pcs	1 pcs 19.610	169.6	3.8	Delete
14	5760	24.000	4.350	0.226	10	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	2 pcs 77.520	pcs	1 pcs 23.060	pcs	100.6	0.2	Delete
15	1920	10.000	7.81	1.780	180	pcs	3 pcs 87.660	pcs	pcs	pcs	1 pcs 62.320	1 pcs 228.900	9 pcs 225.450	pcs	1 pcs 16.700	pcs	pcs	pcs	621.0	14.3	Delete
16	3840	12.000	11.010	2.738	16	pcs	0 pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	1 pcs 19.900	pcs	pcs	1 pcs 15.610	35.5	1.4	Delete
17	5760	16.000	10.460	1.908	150	pcs	pcs	pcs	pcs	pcs	pcs	1 pcs 37.500	pcs	pcs	1 pcs	1 pcs 75.000	1 pcs 19.610	pcs	132.1	5.4	Delete
18						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	0	0	Delete
19						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	0	0	Delete
20						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	0	0	Delete
21						pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	pcs	0	0	Delete

Total Piping Head Loss → Total Head Loss(F1,ftAq): 63.30

fig.10

Table for Sizing Pipe & Pump (IP Edition)

IV : Calculate Pump Head(Hc,ftAq)

$$H_C = F1 + F2 + F3 + F4 + F5 + F6 + F7$$

$$= 63.30 + 20 + 10 + \underline{\quad} + 8 + \underline{\quad} + 6$$

$$= 107.30 \quad ftAq$$

Calculate

F 1 ： Piping Total Head Loss(ftAq)　　　　　　　　* Maker's data are preferred.

F 2 ： Condenser or Evaporator Head Loss(20 ～30ftAq) *

F 3 ： Fan Coil or Air Handling Unit Head Loss(10～20ftAq) *

F 4 ： Heat Exchanger Head Loss(15～ 25 ftAq) *

F 5 ： Adjusting or Balancing Valve Head Loss (5 ～13 ftAq @1/4 closed) *

F 6 ： Cooling Tower Head Loss(ftAq) *

circle: 10 ～23	counter flow: 20 ～30	cross flow: 12 ～20	fan-free: 50 ～65

F 7 ： Other(ftAq)° for : 2 way valve

※Input any descriptions if necessary.　　　　Back　Next　Exit

fig.11

Table for Sizing Pipe & Pump (IP Edition)

V : Calculate Pump Motor Power Required(HP_C)

Calculate

$$HP_C = \frac{Q \times H \times Sg}{3960 \quad \Theta_p \times \Theta_m} = \frac{1920 \times 108 \times 1.00}{3960 \times 0.8 \times 0.9} = 72.73 \ HP = 54.55 \ KW$$

★1 : Recommended　Θp &　Θm : *

Dn , mm	≦50(2")	65(2.5")	80(3")	100(4")	125(5")	150(6")	≧200(8")
Θ p	0.4~0.5	0.45~0.55	0.5~0.65	0.6~0.7	0.65~0.75	0.7~0.8	0.75~0.88
Θ m	0.6~0.7			0.7~0.85		0.8~0.9	

★2 : Sg * : specific gravity　※ 1.00 for 4.4 ~ 37.8 ℃ (40~100 ℉) water

30%wt Ethy. Glycol : 1.05	45%wt Ethy. Glycol : 1.08	160 ℉ water : 0.978

* Maker's data are preferred.

Back　Next　Exit

fig.12

Table for Sizing Pipe & Pump (IP Edition)

VI: Specify Pump's Specifications

Pump Job	flow rate Q, gpm	head H, ftAq	pump eff. θp	motor eff. θm	motor power Hp/Kw	phase/volt	pole	suct./disch. size,in	pump type	remarks
CP1~CP3&SP1	1920	108	0.8	0.9	75 / 55	3 / 380	4	8 / 6	Centrifugal Volute	TEFC Motor

Designer: Andy Ho　　Tel: +886-7-5571755　　Co: Tempace,Inc.

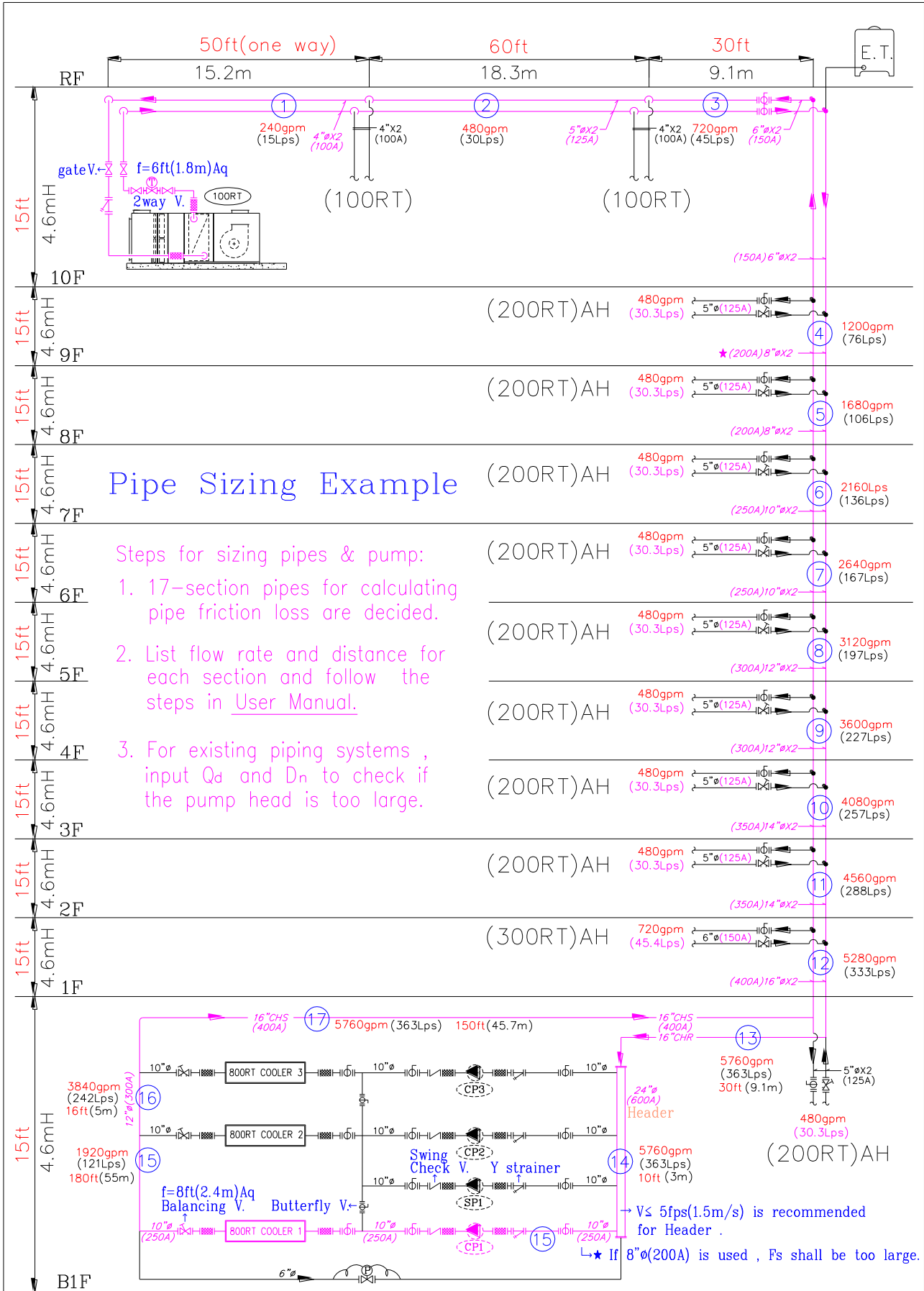Back　Save　Print　End　Restart　Exit

fig.13

Table for Sizing Pipe & Pump   (IP Edition)

Customer:	AEC Company	Project:	Pipe Sizing Sample(for demonstration)	Date:	2008-9-01

I : Select Water System

	Cooling water (open, steel)	Closed pipe (PVC ﹑ABS......)	30%wt Ethy. Glycol (closed, steel)	160 °F Water (closed, steel.)
⊙	Chiller water (closed, steel)	Open pipe (PVC ﹑ABS.....)	45%wt Ethy. Glycol (closed, steel)	Other C= 140	Fu

III : Calculate Piping Total Head Loss (F 1 , ftAq)   ※(1Lps=60Lpm=3.6cmh=15.852gpm ; 1mAq/m = 10 kpa/m=0.1 bar/m ; hm=3.28 ft)

Pipe No	Q gpm	D in	V fps	f ft'/00'	straight pipe length ft	gate valve	butterfly valve	globe valve	angle valve	lift check.V	swing check.V.	y type strainer	90° std. elbow	90° long elbow	tee straight	tee branch	contract D/d=1/3	enlarge d/D=3/4	EL(1)	section head loss Fs, ftAq
1	240	4.000	6.050	3.212	130	4 pcs 10.550 ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	1 pcs 70.400 ft	7 pcs 70.400 ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	151.6	9.0
2	400	5.000	7.700	3.035	120	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	5 pcs 16.840 ft	pcs ft	1 pcs 3.790 ft	1 pcs 5.360 ft	25.9	5.6
3	720	6.000	8.00	3.339	90	pcs ft	2 pcs 45.480 ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 30.510 ft	pcs ft	5 pcs 20.220 ft	pcs ft	1 pcs 4.810 ft	1 pcs 6.870 ft	107.7	6.6
4	1200	8.000	7.700	2.250	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 26.600 ft	pcs ft	5 pcs 26.600 ft	pcs ft	1 pcs 6.790 ft	1 pcs 9.690 ft	43.1	1.6
5	1600	8.000	10.770	4.210	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 26.600 ft	pcs ft	5 pcs 26.600 ft	pcs ft	pcs ft	pcs ft	266	2.4
6	2160	10.000	8.79	2.214	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 33.400 ft	pcs ft	5 pcs 33.400 ft	pcs ft	1 pcs 8.540 ft	1 pcs 12.170 ft	54.1	1.9
7	2640	10.000	10.740	3.210	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 33.400 ft	pcs ft	5 pcs 33.400 ft	pcs ft	pcs ft	pcs ft	33.4	2.0
8	3120	12.000	8.940	1.064	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 39.800 ft	pcs ft	5 pcs 39.800 ft	pcs ft	1 pcs 10.03 ft	1 pcs 15.610 ft	66.3	1.8
9	3600	12.000	10.32	2.429	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 39.800 ft	pcs ft	5 pcs 39.800 ft	pcs ft	pcs ft	pcs ft	39.8	1.7
10	4000	14.000	9.600	1.931	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 43.780 ft	pcs ft	5 pcs 43.780 ft	pcs ft	1 pcs 12.01 ft	1 pcs 17.160 ft	72.9	2.0
11	4360	14.000	10.010	2.373	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 43.780 ft	pcs ft	5 pcs 43.780 ft	pcs ft	pcs ft	pcs ft	43.8	1.8
12	5200	16.000	9.59	1.624	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs 50.020 ft	0 pcs ft	5 pcs 50.020 ft	pcs ft	1 pcs 13.75 ft	1 pcs 19.610 ft	83.4	1.8
13	5760	16.000	10.460	1.900	30	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	2 pcs 75.000 ft	pcs ft	pcs ft	5 pcs 75.000 ft	pcs ft	pcs ft	1 pcs 19.610 ft	169.6	3.8
14	5760	24.000	4.350	0.225	10	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	5 pcs 77.520 ft	pcs ft	1 pcs 23.06 ft	pcs ft	100.6	0.3

fig.14 (first printout)

15	1920	10.000	7.81	1.780	160	pcs ft	3 pcs 87.660 ft	pcs ft	pcs ft	pcs ft	1 pcs 62.92 ft	1 pcs 228.90 ft	9 pcs 225.45 ft	pcs ft	1 pcs 16.700 ft	pcs ft	pcs ft	pcs ft	621.0	14.3
16	3840	12.000	11.010	2.738	16	pcs ft	0 pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	1 pcs 19.900 ft	pcs ft	1 pcs 15.610 ft	pcs ft	35.5	1.4
17	5760	16.000	10.460	1.908	150	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	1 pcs 37.500 ft	pcs ft	pcs ft	1 pcs 75.00 ft	pcs ft	1 pcs 19.610 ft	pcs ft	132.1	5.4
18						pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	0	0
19						pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	0	0
20						pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	0	0
21						pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	pcs ft	0	0

Total Head Loss(F 1 , ftAq) : 63.30

IV : Calculate Pump Head (Ho , ftAq)

$$H_0 = F_1 + E_1 + F_3 + F_4 + F_5 + F_6 + F_7$$
$$= 63.30 + 20 + 10 + + 8 + + 6$$
$$= 107.30 \text{ ftAq}$$

F 1 : Piping Total Head Loss(ftAq)   *Maker's data are preferred.
F 2 : Condenser or Evaporator Head Loss (20~30ftAq) *
F 3 : Fan Coil or Air Handling Unit Head Loss(10~30ftAq) *
F 4 : Heat Exchanger Head Loss(15~25ftAq) *
F 5 : Adjusting or Balancing Valve Head Loss (5~13ftAq @1/4 closed) *
F 6 : Cooling Tower Head Loss(ftAq) *

circle:10~23	counter flow:20~30	cross flow:12~20	fan-free:50~65

F 7 : Other(ftAq) e for : 2 way valve

V : Calculate Pump Motor Power Required (HPc)

$$HP_C = \frac{Q \times H \times Sg}{3960 \times \theta p \times \theta m} = \frac{1920 \times 108 \times 1.00}{3960 \times 0.8 \times 0.9} = 72.73 \text{ HP} = 54.55 \text{ KW}$$

★1 : Recommended θp & θm : *

Dn, mm	≦50(2")	65(2.5")	80(3")	100(4")	125(5")	150(6")	≧200(8")
θp	0.4~0.5	0.45~0.55	0.5~0.65	0.6~0.7	0.65~0.75	0.7~0.8	0.75~0.88
θm	0.6~0.7			0.7~0.85		0.8~0.9	

★2 : Sg * specific gravity ※ 1.00 for 4.4~37.8°C (40 ~100°F) water

30%wt Ethy. Glycol : 1.05	45%wt Ethy. Glycol : 1.08	160°F water : 0.978

*Maker's data are preferred.

VI : Specify Pump's Specifications

Pump Job	flow rate Q, gpm	head H, ftAq	pump eff. θp	motor eff. θm	motor power Hp/Kw	phase\volt	pole	suct./disch. size,in	pump type	remarks
CP1~CP3&SP1	1920	108	0.8	0.9	75 / 55	3 / 380	4	8 / 6	Centrifugal Volute	TEFC Motor

Designer: Andy Ho   Tel: +886-7-5571755   Company: Tempace,Inc.

fig.15 (second printout)

Pipe Sizing Example

Steps for sizing pipes & pump:

1. 17-section pipes for calculating pipe friction loss are decided.

2. List flow rate and distance for each section and follow the steps in User Manual.

3. For existing piping systems, input Q_d and D_n to check if the pump head is too large.

RF
50ft(one way) 15.2m
60ft 18.3m
30ft 9.1m
E.T.

① 240gpm (15Lps) 4"øX2 (100A) 4"X2 (100A)
② 480gpm (30Lps) 5"øX2 (125A) 4"X2 (100A)
③ 720gpm (45Lps) 6"øX2 (150A)

(100RT)
(100RT)

gate V.
f=6ft(1.8m)Aq
2way V. 100RT

15ft 4.6mH

10F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
④ 1200gpm (76Lps)
★(200A)8"øX2

9F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑤ 1680gpm (106Lps)
(200A)8"øX2

8F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑥ 2160Lps (136Lps)
(250A)10"øX2

7F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑦ 2640gpm (167Lps)
(250A)10"øX2

6F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑧ 3120gpm (197Lps)
(300A)12"øX2

5F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑨ 3600gpm (227Lps)
(300A)12"øX2

4F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑩ 4080gpm (257Lps)
(350A)14"øX2

3F
(200RT)AH 480gpm (30.3Lps) 5"ø(125A)
⑪ 4560gpm (288Lps)
(350A)14"øX2

2F
(300RT)AH 720gpm (45.4Lps) 6"ø(150A)
⑫ 5280gpm (333Lps)
(400A)16"øX2

1F
16"CHS (400A) ⑰ 5760gpm (363Lps) 150ft(45.7m) 16"CHS (400A)
16"CHR ⑬
5760gpm (363Lps) 30ft (9.1m)
5"øX2 (125A)

3840gpm (242Lps) 16ft(5m) ⑯ 12"ø(300A)
10"ø 800RT COOLER 3 10"ø CP3 10"ø
24"ø (600A) Header

1920gpm (121Lps) 180ft(55m) ⑮
10"ø 800RT COOLER 2 10"ø CP2 10"ø
5760gpm (363Lps) 10ft (3m) ⑭
(200RT)AH

f=8ft(2.4m)Aq
Balancing V. Butterfly V.
Swing Check V. Y strainer
10"ø (250A) 800RT COOLER 1 10"ø (250A) CP1 ⑮ 10"ø (250A)
SP1

→ V≤ 5fps(1.5m/s) is recommended for Header.
↳★ If 8"ø(200A) is used, Fs shall be too large.

480gpm (30.3Lps)

B1F 6"ø P

15ft 4.6mH (repeated each floor)

fig.16 (refer to fig.14&15)

Appendix：Installation for Pipe 2.0

※ This package of **Software Pipe 2.0** includes one CD-ROM and one USB Key.

A、Install software into your computer

（1）This CD-ROM includes *InstDrv.exe*、*Pipe En_Setup.exe* and *Installation.pdf*.

（2）Click *InstDrv.exe* and follow the steps shown on the screen (fig.1~3).

（3）Click *Pipe En-setup.exe* and follow the steps shown on the screen(fig 4~6).

（4）After completing installation，all contents shall be copied into **disc C** with file name 「*Pipe En_*」，and program 「*Pipe English*」will be shown on the Desk Top as a shut-cut.
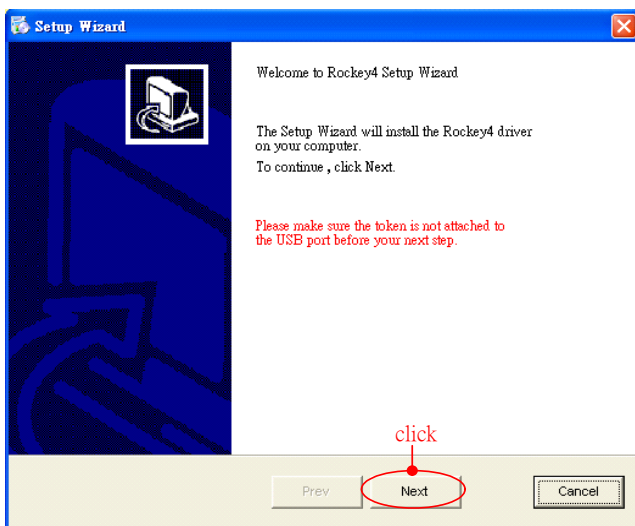
fig.1
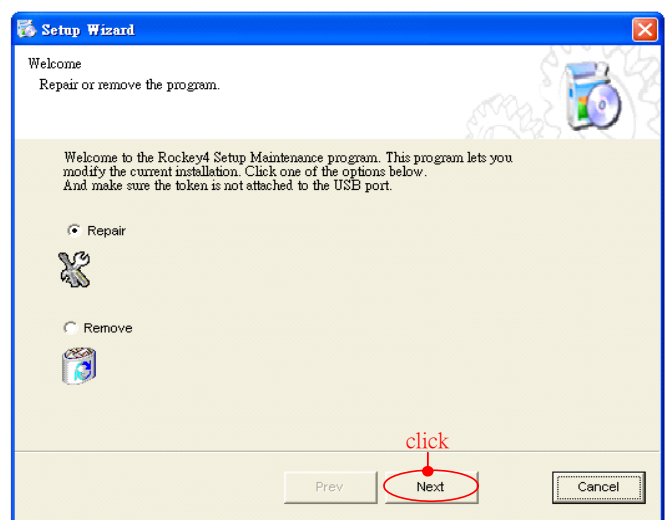
fig.1'（for repair if necessary）
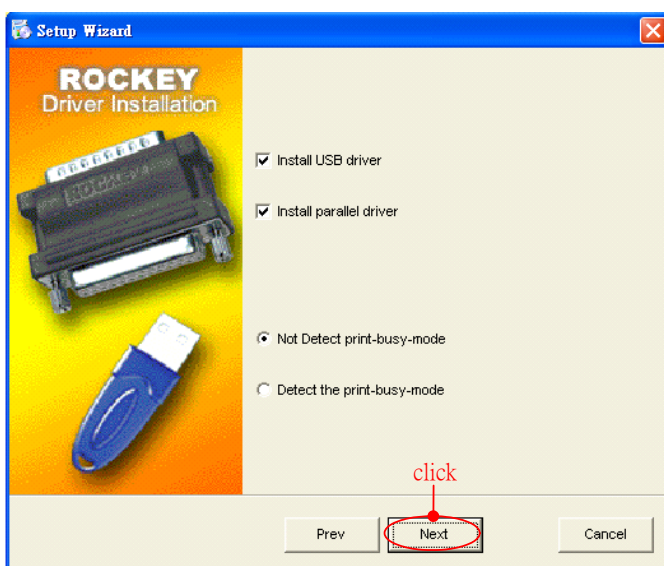
fig.2
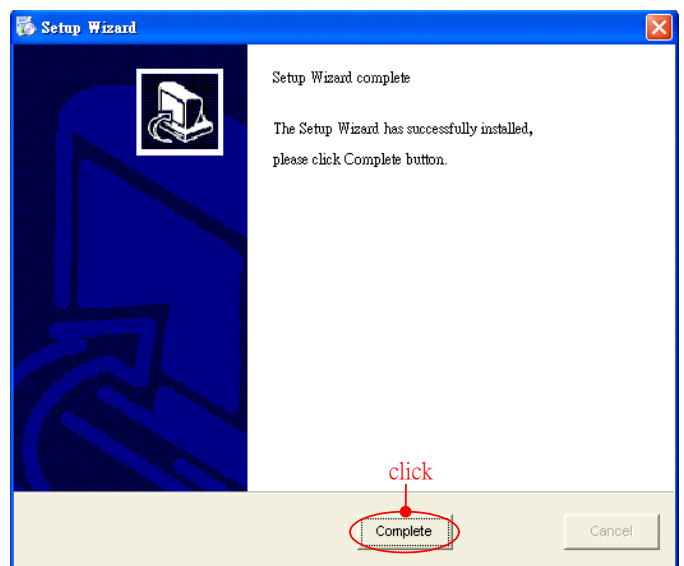
fig.3
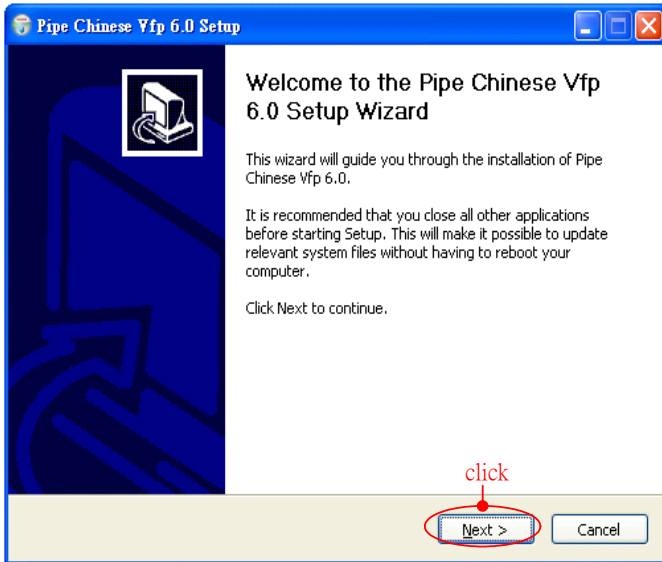
fig.4
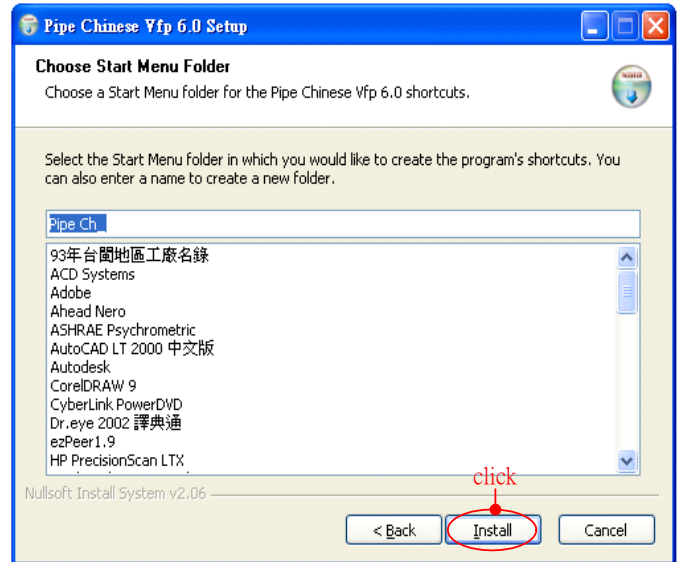
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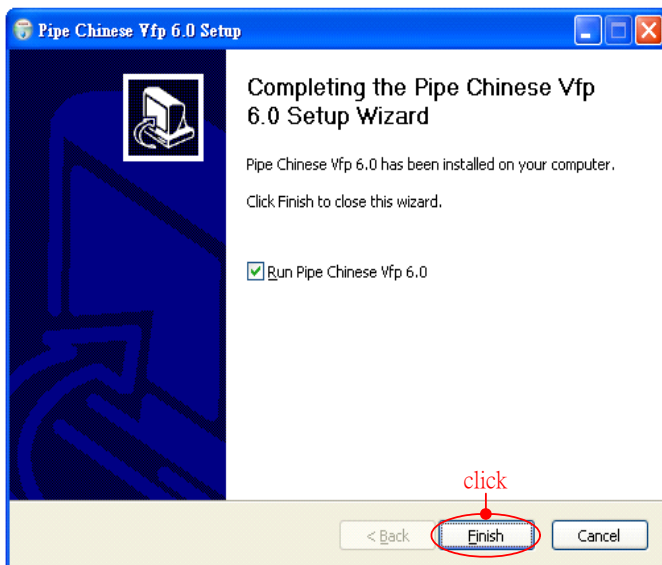
fig.6
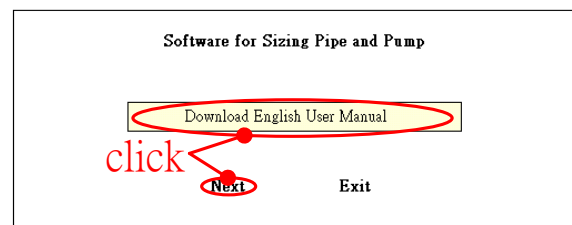
fig.7

B、Operate the program

（1）Plug Key into USB port.

（2）Double click shut-cut 「*Pipe English*」on the Desk Top，and fig.7 will be shown on screen. Click <u>Download English User Manual</u> if necessary.

Note1：If the screen shows warning message "No Key！"，that means Key Driver has not been installed completely，or has been removed，please follow step A(2)above，install or repair again.

Note2：During operation，key can not be pull out；otherwise pipe sizing can not be proceeded.

Note3：In this software, file「Pipe En-」，program「Pipe English.exe」is for pipe sizing operation, and 「InstDrv.exe」is for installing or repairing key driver program. Others are protected. If you try to open these protected files/programs without success for 3times，this software could be out of order forever.

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